COMPARISONS OF SOME ANDEAN BUTTERFLY FAUNAS

By WILLIAM HOVANITZ (1)

Observations of the butterfly fauna at significant points along the top of the Andean mountain chain from near Venezuela in Colombia to central Ecuador in comparable ecologic niches has brought out some interesting facts concerning the sub-ecological preferences of the species and their intercombination in building up the fauna of a particular region.

The geographical points especially noted in this paper are spacially marked on a map published in a corresponding paper on the Colias of this region. They represent meadow lands at between 2600 to 2950 meters elevation above the sea and between nearly 7° North latitude and 2° South latitude. The topographic aspects of each place are described in the preceding paper, which, to avoid duplication, will not be repeated here. The two papers are supplementary in this regard (Hovanitz, 1944).

The geographical distributions of the butterflies as they were observed at various times from December through April (dry season) are shown on the graph (fig. 1). Cerrito. Tunja-Paipa and Bogotá are in the eastern cordillera of Colombia isolated from the main range. Santa Rosa. Sonsón and Puracé are in the relatively small meadow portion of the central cordillera of Colombia, and Pasto, Ipiales, Quito and Riobamba are in the main Andean mountain range of Colombia and Ecuador. Butterflies seen in these localities but not listed in the table are omitted because they apparently occupied ecological niches too different from that of the center of interest (*Colias dimera*) and their absence would be of no significance in other places. Negative evidence is always of considerably less significance than positive, yet it is very important.

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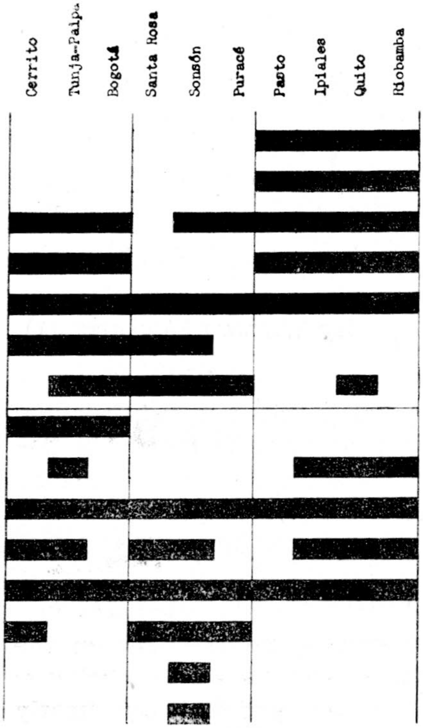
(1) Fellow of the National Research Council, Washington, D. C., U. S. A.



Species	Type	Preference
Colias cunninghami	Boreal	Fria
Itylos spp.	Boreal	Fria
Colias dimera	Boreal	Fria
Tatochila xanthodice	Boreal	Fria
Pyrameis hunteri	Boreal	Fria
Pyrameis huntera	Boreal	Fria
Papilio america	Boreal	Fria, Templada
Nathalis plauta	Equatorial	Fria
Precis lavinia	Equatorial	Varied
Terias arbela (group)	Equatorial	Varied
Euptoieta sp.	Equatorial	Varied
Leptotes cassius callanga	Equatorial	Varied
Pieris aripa	Equatorial	Templada
Anartia jatrophae	Equatorial	Caliente
Terias limbia	Equatorial	Caliente

Fig. 1.—The comparative distributions of some meadow butterflies in the *Tierra Fría* of Colombia and Ecuador. The first three localities are in the eastern cordillera of Colombia, the second three in the central cordillera of Colombia and the last four in the main Andes of southern Colombia and northern Ecuador. The map (Hovanitz, 1944) gives the spacial distribution of these localities.

The classification into a meadow butterfly is primarily based upon the existence of the larval food plant of the species in meadows, thus leading to the presence of the adult butterflies in this habitat. However, even of the common butterflies here considered only a portion of the food plants are known exactly so that it is best to omit this from the present discussion.

The Butterfly types (2)

All the populations being considered lie in the *Tierra Fria,* a climatic zone of the equatorial Andes somewhat similar to the temperate and alpine zones of the higher latitudes. Being near the equator, however, these places lack the cold winters which in the north regulate so closely the activity and distribution of the cold-blooded animals. For this reason, the *Tierra Fría* or *Zona Fría* is favorable for the existence of the northern temperate zone types which prefer cold temperature and also for tropical types which cannot withstand freezing temperatures. The butterflies are therefore separable into boreal (northern types) and tropical types as concerns their affinities phylogenetically (see fig. 1).

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(2) The authorities for names of butterflies used in this paper are the same as used in Hovanitz, 1944.

A further classification is made based upon the specific distribution of the butterfly in the zones *Fría, Templada,* or *Caliente,* using the Spanish terms since they are more descriptive and have no northern hemisphere meanings for confusion. The use of the term *varied* in the table means that the particular butterfly ocurred indiscriminately in all three zones.

For example, *Colias cunninghami* is a butterfly of boreal origin and lives only in the *Zona Fría*. *Nathalis plauta* is a butterfly of closest affinities in the equatorial regions only, yet this particular species exists only in the *Zona Fría*. *Precis lavinia* is a species of definite tropical affinities but yet exists in all zones from *Caliente* to *Fría;* therefore, it is listed as *varied*. With these examples, the others are self-evident.

FACTS OF DISTRIBUTION DERIVED FROM THESE DATA

Types of butterflies comparatively similar to *Colias cunninghami* and *Itylos* spp. (boreal *Plebejus*) occur in the northern hemisphere only in climatic zones considered very cold, such as the Hudsonian and Artic-alpine life zones. The distribution in the Andes from Pasto to Riobamba, and not further north, suggests either a lack of these zones, a smaller extent of them and/or isolation so that such forms of life could not reach the proper environment. Since these are the forms preferring the coldest places in the northern latitudes, they are expected to choose the coldest in this region too.

Types of butterflies similar to *Colias dimera* and *Tatochila xanthodice* occur in the northern hemisphere in the intermediate temperate climates (Transition and Canadian). The extension in range over the above two forms indicates that the new territory occupied has a warmer climate. Both cover the localities in the eastern cordillera

(Cerrito, Tunja-Paipa and Bogotá) which are one or two hundred meters lower in altitude than the localities in the main range and are one or two degrees warmer in median temperature. In addition, *Colias dimera* exists in Sonsón and Puracé where *Tatochila* has not been located. The melanin pigment on the wing surface of *Tatochila* is much darker and extended in the material from the zone Pasto to Riobamba than in material from the eastern Cordillera. This is usually an indication of colder developing temperatures for the insects.

In North America, the two *Pyrameis* (*Vanessa*) occupy partly overlapping but yet largely differing geographical distributions. *P. huntera* is the commonest eastern form, occurring throughout the Atlantic coast area, the Mississippi Valley and Mountain area to the Pacific coast where it is rare. *P. carye* is the common Pacific coast form. Yet, they overlap widely without hybridization. There is no visible altitudinal difference in Andean distribution, yet, *carye* was not located in the southern main Andean zone, the coldest portion. Since the Pacific coast of North America has relatively warmer winters than the eastern portions, it may be that *carye* is unadapted to the cold temperatures that are satisfactory for *huntera* in the northern range as well as the Andean. On the other hand, *Pyrameis* are often variable in abundance and the absence is perhaps not to be taken too seriously for this species.

The distributional range of *Papilio america* (or the *machaon* group) is sporadic owing to the sporadic distribution of some of its food plants, the Umbelliferae. Apparently, *P. america* will extend any place where Umbelliferae of the proper varieties will go since it exists high on the cold mountain slopes of Ecuador and in the warm Cauca valley; its primary Andean home though seems to be in the higher places. Nothing important is thus discernible in the distributional range shown on the graph except perhaps its greater scarcity to the south, its known distributional range ending in northern Perú.

Of the meadow butterflies of tropical origin which exist in the *Zonas Fria, Nathalis plauta* is perhaps the only one restricted to this belt. Perhaps due to isolation or other factors unknown, its distributional range is not beyond the *Tierra Fria* of Colombia's *Cordillera Oriental* and its continuation in Venezuela.

Several meadow butterflies lack specificity in their preferences of temperature above that of the freezing of water. *Precïs lavinia,* *Euptoieta* sp., *Terias arbela* and *Leptotes cassius* occur in one of their local forms at all elevations from near sea level to 3000 meters in elevation requiring only cut-over land or meadows. The incompleteness in the distribution as shown does not seem to have any great significance.

Pieris aripa belongs to an ecologic belt of a lower elevation than that of the localities listed. It has been encountered very commonly at about 2000 meters in elevation. Its presence in certain localities seems to be related with the topographic features of the area. That is, where the locality is in a canyon with a telescoping of the altitudinal climatic differences, it is always present (Cerrito, Sonsón and Puracé), or where other topographic features have caused conditions to become of a warmer type and the true *Tierra Fria* forms are absent (Santa Rosa). An excellent example is in the vicinity of Bogotá. *Pieris aripa* has not been observed in the actual savanna of Bogotá but it is very frequent at the same elevation over the range where the elevation drops sudenly to below 2000 meters at Chipaque.

The presence of two definite tropical zone indicators at 2500 meters in elevation at Sonsón and the rarity of *Tierra Fria* indicators is an indication that the place is at the lower limit of the latter zone. Perhaps at other places where meadows of the *Tierra Templada* and *Caliente* reach connection with the *Tierra Fría, Anartia jatrophae* and *Terias limbia* will be encountered.

DISCUSSION AND SUMMARY

The data presented show how the butterfly fauna of a given "ecologic niche" is composed of species having different origins, different ecological preferences and different spacial distributions. The fauna of a given place in the *Tierra Fría* of the equatorial Andes is composed of several classes of butterflies divisible into two main groupe, namely, those of boreal origin and those of equatorial origin. Each of these groups can then be divided into other units based upon specific ecologic preference, such as the zones *Fría, Templada* and *Caliente*. But between each of these units no real boundary line can be drawn; each species has its own specific preferences which may occasion straddling or overlapping boundary lines. Some species are very narrow in their preference occupying only a small portion of a zone; others are very wide, occupying all of one, two or three zones.

The gene frequency distributions in Colias as presented in another paper are in excellent agreement with the conclusions reached in this paper as to the characteristics of the various environments.

LITERATURE CITED

HOVANITZ, W. 1944. The distribution of Colias in the Equatorial Andes. CALDASIA, (this issue).